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## NOTES ON SOME LITTLE-KNOWN FISHES FROM THE NEW YORK DEVONIAN.

BY BURNETT SMITH.

*Machæracanthus* and other Fish Remains from the Oriskany Sandstone.—So far as the writer has been able to learn the literature of Paleontology contains no reference to the occurrence of fish remains in the Oriskany sandstone of New York. Beyond the boundaries of the State fossils of this nature have been reported from beds which are believed to be contemporaneous with the type Oriskany. Eastman<sup>1</sup> mentions the scales of *Thelodus* from "Oriskany sandstone" at Nictaux Falls, N. S., while Newberry,<sup>2</sup> in his monograph makes the following statement: "Neither in New York nor farther south has the Oriskany sandstone yet furnished any remains of fishes, but it is to be expected that when sought for patiently and discriminately they will be discovered. In Canada, north of Lake Erie, where the characteristic fossils of the New York Oriskany are associated with those of the Corniferous limestone, spines of *Machæracanthus* and fragments of plates with a stellate tuberculation, probably of *Macropetalichthys*, have been found."

In the vicinity of Syracuse, N. Y., the presence of bone fragments and of spines in the phosphatic nodules of the Oriskany has been known to local collectors for some time. Several years ago Mr. Charles E. Wheelock, of Syracuse, obtained a spine from one of these concretions at Britton's quarry, Onondaga County (just south of the Syracuse city line). This specimen has unfortunately been lost, but the writer feels that he can accept without reserve the determination of so careful an observer as Mr. Wheelock.

In 1908, Mr. Charles Hares, then a graduate student at Syracuse University, while studying the stratigraphic relations of the Oriskany sandstone, brought to my notice a number of fragmentary fossils from the phosphatic nodules at the quarries east of Manlius, Onondaga County.

With the exception of a few obscure pieces of bone, some collected

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<sup>1</sup> *New York State Museum Memoir 10*, p. 13.

<sup>2</sup> *Monographs U. S. G. S.*, vol. XVI, p. 25.

from the rock in place and one from a drift boulder, no other specimens have until recently come to the attention of the writer. It is to Mr. Wheelock that we are again indebted for the discovery of additional and better preserved material. This latter, together with two of the Manlius specimens, allow of the determination of one genus, *Machæracanthus*, with certainty, and it is believed that characters differing from those of previously described species indicate that the form in question is new. It is not, however, thought advisable to introduce a new specific name, for it is possible that the features observed may be merely the result of individual variation in some long-known species of the genus.

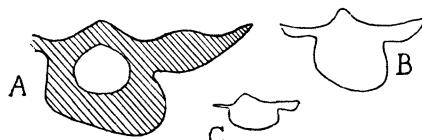


Fig. 1.—A and B, proximal cross sections, and C, distal cross section of *Machæracanthus* spines from the Oriskany sandstone of Onondaga County, New York. B and C are sections of the same spine. All are enlarged twice.

The Oriskany *Machæracanthus* may be briefly described as follows: Spines having a measured width of 16.5 mm. Length probably exceeding 100 mm. This would be a spine of about the size of *M. peracutus* Newb. and *M. sulcatus* Newb., but much smaller than *M. major* Newb. The angle of convergence of the sides of the spine is less than in any of the above-mentioned species, one measurement showing that the width decreases from 10 mm. to 3 mm. through a length of 54 mm. The curvature is apparently about the same as that met with in *M. peracutus*. Central cavity large. The cross section of the spine is highly characteristic and changes greatly in its outline distally. In the more proximal portions the spine is marked by very sharp "wings" and an angulated ridge is present on the outer (?) side while the inner (?) carries a much rounded and swollen ridge. Distally the "wings" are shorter, while the two ridges, though still maintaining their general character, become less pronounced. External surface punctate with distally convergent striae.

These Oriskany specimens are distinguished from those previously described by the cross section. In this feature they most resemble *M. longævus* Eastman<sup>3</sup> from the New York Hamilton, while in general

<sup>3</sup> *New York State Museum Memoir 10*, p. 85, pl. 2, fig. 8.

proportions they approach *M. peracutus*. Location and Horizon—Oriskany sandstone; Manlius and Britton's Quarry, Onondaga County, New York.

The writer believes that it is not out of place to append here the following notes concerning the range and distribution of the described species of *Machæracanthus*.

***Machæracanthus peracutus* Newb.**

Middle Devonian. Columbus and Delaware limestones of Ohio, Onondaga (Corniferous) limestone of New York.

***Machæracanthus sulcatus* Newb.**

Middle Devonian. Ohio. Onondaga limestone of New York. Gaspé sandstone of Canada.<sup>4</sup>

***Machæracanthus major* Newb.**

Middle Devonian, Columbus and Delaware limestones of Ohio.

***Machæracanthus longævus* Eastman.**

Middle Devonian. Hamilton of New York.

***Machæracanthus bohemicus* (Barrande).**

Devonian of Europe.

The specimens from the vicinity of Syracuse definitely extend the range of the genus to the Oriskany sandstone and, as stated before, probably represent a new species. We know, however, practically nothing of the morphology of *Machæracanthus*, and if, as has been suggested, it is a gigantic Acanthodian, the probability is strong that even in one individual spines might have occurred whose curvatures and cross sections differed greatly.

In addition to the fossils assignable to *Machæracanthus*, the Manlius locality has yielded other though much less satisfactory fish remains. These are so poorly preserved that little can be said of them beyond the fact that they present the appearance of badly weathered Arthrodiran plates.

*Note on the Plates of Dinichthys halmodaeus (Clarke)?*—The structure of the abdominal armor in *Coccosteus* and especially in *C. decipiens* Ag. has been well understood for many years. The other genera of Arthrodires, however, seldom furnish us with anything but scattered plates, and this is more particularly true of the ventral shield. In

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<sup>4</sup> *New York State Museum Memoir 10*, p. 191.

*Dinichthys* Eastman,<sup>5</sup> Dean<sup>6</sup> and Von Koenen<sup>7</sup> have described more or less complete specimens of the ventral covering with its elements in nearly the positions occupied during the life of the animal. In these cases the several species of *Dinichthys*, to which the ventral shields have been referred, are typical examples of the genus. The ventral armor of the primitive species usually included in *Dinichthys* (such as *D. halmodeus*) has until recently remained unknown.

In the summer of 1908 the writer was so fortunate as to obtain a specimen of the ventral armor of a small arthrodire from the Marcellus shale (Middle Devonian) of central New York. Although no definite specific determination has been attempted, it is highly probable that the specimen in question represents the plastron of *Dinichthys halmodeus* (Clarke). Though originally described as *Coccosteus*,<sup>8</sup> most recent authors have included this species in *Dinichthys*, all agreeing, however, that it holds a position only slightly removed from the former ancestral genus. The chief reasons for assigning this armor to *D. halmodeus* are (1) similarity of superficial tuberculation, (2) geographical and geological position, and (3) the fact that this ventral shield possesses just such primitive characters as would naturally correspond with those exhibited by the dorsal plates and head shields of the type material of the species.

A detailed description of this ventral shield has been given elsewhere,<sup>9</sup> and for our present purposes it is sufficient to say that the plates are in their original position, the antero-ventromedian and postero-ventromedian, both postero-ventrolaterals, and one antero-ventrolateral are practically entire, while the other antero-ventrolateral is mostly retained. The outline of this latter plate can, however, be restored from that of its well-preserved fellow on the other side. In addition to these ventral plates the specimen shows both the antero-dorsolaterals and the right postero-dorsolateral. Two other bones associated with those already named were originally regarded as a probable suborbital and as a possible antero-supernathal. A

<sup>5</sup> C. R. Eastman, "On the Relation of Certain Plates in the Dinichthyids," *Bull. Mus. Comp. Zool.*, Harvard, vol. XXXI, pp. 26, 27, pl. I, fig. 2, and pl. IV.

<sup>6</sup> Bashford Dean, "On the Vertebral Column, Fins, and Ventral Armoring of *Dinichthys*," *Trans. N. Y. Acad. Sci.*, vol. XV, pp. 157-163, pls. VII and VIII; "Note on the Ventral Armoring of *Dinichthys*," *Trans. N. Y. Acad. Sci.*, vol. XVI, pp. 57-60, pl. III.

<sup>7</sup> A. von Koenen, "Ueber einige Fischreste des norddeutschen und böhmischen Devons," *Abhandl. k. Gesell. Wiss.*, Göttingen, vol. XL.

<sup>8</sup> John M. Clarke, "New and Rare Species of Fossils from the Horizons of the Livonia Salt Shaft," *Rep. State Geologist*, New York, 1893, p. 161.

<sup>9</sup> Burnett Smith, "On Some Dinichthyid Armor Plates from the Marcellus Shale," *Am. Nat.*, vol. XLIII, Oct., 1909.

more careful examination of these bones has led the author to reconsider these provisional determinations and to come to the conclusion that the elements in question are in no way connected with the head-shield, but are part of the "clavicular" and lateral armoring.

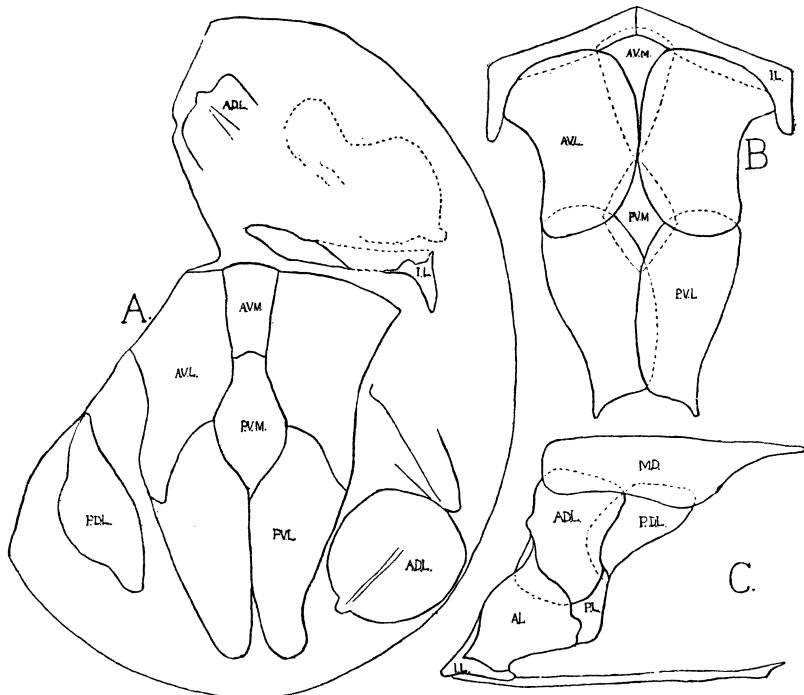


Fig. 2.—A, *Dinichthys halmodaeus* (Clarke)? Marcellus shale near Syracuse, N. Y. Black lines are traced from a photograph. Dotted lines represent restored outlines. In the case of the interlateral the dotted lines follow impressions in the matrix. Length of ventral shield about 195 mm.

B, *Coccosteus decipiens* Ag. Restoration of the ventral armor (modified from Traquair).

C, *Coccosteus decipiens* Ag. Restoration of abdominal armor side-view (modified from Traquair).

A.V.M., antero-ventromedian; P.V.M., postero-ventromedian; A.V.L., antero-ventrolateral; P.V.L., postero-ventrolateral; P.D.L., postero-dorsolateral; A.D.L., antero-dorsolateral; I.L., interlateral; A.L., anterolateral; P.L., posterolateral; M.D., dorsomedian.

Fig. 2 A represents a tracing taken from the photograph of the original specimen. The plates of the ventral shield are all capable of certain identification, as are also the two antero-dorsolaterals and the postero-dorsolateral. Immediately forward of the ventral shield is a group of bones which at first appear to be hopelessly confused.

If, however, we examine Traquair's<sup>10</sup> restoration of *Coccosteus decipiens* Ag., we find that in this region occur two well-defined transverse elements which are terminated at their outer extremities by processes which are directed backward and upward. In the specimen here considered it can be proved by a careful examination of impressions on the matrix that the bone originally believed to be an antero-superognathal is not a short compact element, but is in reality a fragment once connected with a long transverse bone which borders the anterior margin of the left antero-ventrolateral. The part believed to be a gnathal then becomes the upwardly and backwardly directed fork of the interlateral shown in Traquair's restoration of *Coccosteus decipiens*. The evidence for this interpretation is twofold—(1) the shape of the bone corresponds to the Coccostean interlateral and (2) the bone is in exactly the position where we might expect to find such an element.

In *Coccosteus decipiens* this interlateral plate has a rodlike ventral portion and a lateral portion with its two processes, one directed dorsally, the other posteriorly. Between these two processes fits the lowest plate of the lateral armoring, namely, the anterolateral. This anterolateral articulates behind with the small posterolateral and above it overlaps the antero-dorsolateral. It therefore serves to link the ventral to the dorsal shield.

If, now, we turn to the higher species of *Dinichthys*, such as *D. intermedius* Newb., we find that apparently the Coccostean interlateral, the Coccostean anterolateral and perhaps even the Coccostean posterolateral have fused together into one large bone, the so-called "clavicular." We say apparently, for though some specimens exhibit the condition shown in Newberry's classic illustration,<sup>11</sup> others occur with the two components (the lower rodlike portion and the upper platelike portion) separate. Eastman<sup>12</sup> has homologized the broad portion of the "clavicular" with the Coccostean anterolateral and its lower portion with the Coccostean interlateral.

Though not wishing to express too hasty an opinion, the author believes that the restoration of *Dinichthys* would present fewer difficulties if we could regard the lower (interlateral) portion of the "clavicular" as an element distinct from the upper (anterolateral) portion.

<sup>10</sup> R. H. Traquair, "On the Structure of *Coccosteus decipiens*, Agassiz," *Ann. and Mag. Nat. Hist.*, 6th ser., vol. V, 1890, p. 125.

<sup>11</sup> *U. S. G. S.*, Monographs XVI, pl. XLVIII. See also Hussakof, in *Mem. Am. Mus. Nat. Hist.*, vol. IX, part III, p. 133.

<sup>12</sup> *New York State Museum Memoir* 10, p. 119.

Considering, now, the specimen dealt with in this paper, we find that the interlateral shows no positive evidence of fusion with any other bone and seems to agree with the condition met with in *Coccosteus decipiens*. Further, it may be stated that its posterior margin looks as if it might have carried the thin blade found in *D. intermedius*, but the condition of preservation hardly warrants a final decision on this point.

If, now, we examine the plate which was at first believed to be a suborbital, we find that it is apparently only a part of a larger bone, the fragments of which lie (in the figure) to the left of the big mass. When a reconstruction of this bone is attempted, its outline is, in a general way, quite similar to that made by the combined antero- and posterolaterals of *Coccosteus* or the broadly expanded upper portion of the "clavicular" in *Dinichthys*. The author offers the suggestion, therefore, that this bone probably represents a lateral plate of some kind. In support of this suggestion it may be said that the bone in question occupies just such a position as that in which we might expect to find a lateral plate when the entire abdominal armor is so crushed that the dorsal and ventral plates are brought into the same plane. According to this hypothesis, the plate was not only brought into the horizontal plane, but also rotated forward through an angle of about ninety degrees. The same pressure pushed the left antero-dorsolateral backward while it turned over with its outer side exposed. The right antero-dorsolateral in coming to rest in the same plane with the others was pushed far forward of its natural position.

Though realizing that any conclusions in regard to the strictly lateral armoring which may be based upon this specimen are only tentative, the author believes that he may safely express the opinion that the interlateral in this Marcellus Dinichthyid occupies practically its normal position, that in this respect it agrees with *Coccosteus*, and that it offers a clue which may be of importance in properly orienting the "clavicular" (be it one element or two) in the higher Dinichthyids.

*Acanthodian Remains from the Marcellus Shale.*—These remains of Acanthodians are quite fragmentary, but the extreme rarity of the members of this order in the Paleozoic strata of North America render advisable a short description of these two Middle Devonian specimens. One specimen collected by the writer came from the Marcellus shale of the Kimber Springs Ravine, southwest of Onondaga Valley, N. Y. It comprises but a single spine less than 15 mm. in length. The proximal portion is imperfect, but distally it tapers off in a graceful curve to the nearly complete point. Three longitudinal grooves and ridges are plainly visible.

The other specimen was collected from the Marcellus shale of Richfield, N. Y., by the late Prof. C. E. Beecher. It forms part of the Newberry Collection at the American Museum of Natural History. Newberry was fully aware of the nature of the fossil, for he refers to Acanthodian remains very briefly on page 61 of his monograph as having been collected by Beecher from this horizon. Subsequent authors have not mentioned it. This Richfield specimen displays a spine, numerous scales and an undetermined plate. The fossil lies in a bedding plane of the thinly laminated shale in such a way that when the block was broken a portion of the fish adhered to the rock on either side. An examination of the spine indicates that the Richfield and Kimber Springs specimens are specifically identical. The spine, though less perfectly preserved, exhibits the same proportions, curve and longitudinal ridges. When complete it must have been over 33 mm. in length. The scales are relatively large, four-sided and apparently unsculptured. The specimen is of good size for an Acanthodian, and though any estimate of its length must be very rough, we are undoubtedly justified in assuming that the complete fish was at least 175 mm. long.

Though Acanthodian remains have been reported from the Lower and Upper Devonian of the Atlantic Border province and from the Upper Devonian of the New York province, these specimens represent the earliest examples of undoubted Acanthodians which have been found in the latter region.

In the Atlantic Border province the following forms have been reported:<sup>13</sup> *Acanthodes semistriatus* Woodward, *Cheiracanthus costellatus* Traquair, *Climatius latispinosus* (Whiteaves) from the Lower Devonian of Campbellton, N. B., and *Diplacanthus striatus* Ag., *D. horridus* Woodward, *Acanthodes affinis* Whiteaves, *A. concinnus* Whiteaves from the Upper Devonian of Scaumenac Bay, Quebec.

In the New York province we have: *Acanthodes* (?) *pristis* Clarke, Rhinestreet shale, Upper Devonian, near Sparta, N. Y. An unnamed Acanthodian, Marcellus shale, Middle Devonian, Richfield, N. Y., and Kimber Springs, near Onondaga Valley, N. Y.

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<sup>13</sup> C. R. Eastman, *New York State Mus. Mem.* 10, pp. 13, 16, 17. Also O. P. Hay, *U. S. G. S.*, Bull. 179, pp. 273, 274.